5.8 Traffic and Transportation

This section evaluates the radiological and non-radiological impacts of onsite shipments of LLW, MLLW (including melters), TRU waste, and ILAW to treatment and disposal facilities, offsite shipments of MLLW from Hanford to offsite treatment facilities and back, and the shipment of construction and capping materials. This section also presents the impacts of shipments of LLW and MLLW from offsite generators to Hanford treatment and disposal facilities and shipments of TRU waste from Hanford to the Waste Isolation Pilot Plant (WIPP) for disposal. The impacts of shipments of LLW, MLLW, and TRU waste from offsite generators to Hanford and from Hanford to WIPP are also presented for the states of Washington and Oregon. The impacts of shipments of LLW, MLLW, and TRU from offsite generators to Hanford were calculated for the states of Washington and Oregon using methods and data that are consistent with the Waste Management Programmatic Environmental Impact Statement (WM PEIS, DOE 1997a). Estimated impacts of transporting TRU wastes to WIPP are scaled from information presented in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997b).

The types of impacts evaluated and the approaches taken to quantify the transportation impacts are summarized as follows:

Radiological impacts of routine (incident-free) transport. These impacts result from routine or incident-free transportation of radioactive materials where the shipments arrive at their destinations without releasing any of the shipment contents. The impacts arise from exposing truck crews and the population on or near the highways to low radiation dose rates emitted from shipping containers that carry radioactive materials. The RADTRAN 4 computer code (Neuhauser and Kanipe 1992) was used to quantify the impacts of incident-free transportation of waste materials.

Radiological impacts of accidents. These impacts result from accidental releases of radioactive material in transit. Accident impacts are determined by combining the probabilities and consequences of potential transportation accidents, ranging from minor to severe accidents, and then integrating them over the entire shipping campaign. The RADTRAN 4 computer code was used to quantify these impacts.

Non-radiological impacts of routine transportation. Non-radiological impacts of routine transportation are the health effects that result from routine emissions of hydrocarbon pollutants and dust from the truck tractors used to haul waste as well as capping and construction materials. These impacts are not related to the radioactive nature of the waste shipments. They are calculated using a unit factor approach (that is, latent cancer fatalities [LCFs] per km) using data taken from Rao et al. (1982) that has been used in many past EISs.

Non-radiological impacts of traffic accidents. These impacts result from physical trauma fatalities caused by traffic accidents involving the heavy trucks used to transport waste, construction, and capping materials. A unit factor approach based on accidents and fatalities per km was used to develop the non-radiological accident impacts. Unit factor data were taken from Green et al. (1996) for onsite shipments and from Saricks and Tompkins (1999) for offsite shipments.

Hazardous chemical accident impacts. These impacts are the result of potential accidental releases of hazardous chemical constituents that are contained in MLLW and TRU shipments, such as lead and mercury. A maximum credible accident approach was used to quantify the impacts. Hazardous chemical release and atmospheric dispersion calculations were performed to determine the maximum downwind concentration to which an individual would be exposed. The downwind concentrations were compared to safe exposure levels for each chemical to determine the potential public and worker impacts.

All of these methods are commonly used in DOE environmental documents. Detailed descriptions of these methods, the input data that were used in the transportation impact analysis, and detailed results are presented in Appendix H.

Table 5.20 presents the results of the analysis of radiological routine and accident impacts, as well as non-radiological accident and routine emission impacts. All of the impacts provided in this table are in fatalities, except for the estimated number of traffic accidents. Fatalities are expressed in LCFs for radiological impacts and routine non-radiological emissions and in terms of physical-trauma-induced fatalities for non-radiological accidents. Note that many of the entries in the table are expressed as fractional fatalities (for example, 1E-01 or 0.1 fatalities). However, fatalities occur only as whole numbers and the totals have been obtained by rounding to the nearest whole number.

The results in the table indicate that Alternative Group B results in the lowest transportation impacts of all the alternatives. This is because most MLLW is treated onsite in this alternative so there are fewer offsite shipments of MLLW in Alternative Group B than were projected in the other Alternative Groups. However, the differences in impacts among the alternatives are small.

The impacts of shipments of solid waste from offsite generators to Hanford and shipments of TRU waste from Hanford to WIPP are summarized in Table 5.21. In response to public comments on the first draft of this EIS, the impact results are presented here for the States of Washington and Oregon, as the WM PEIS previously analyzed the impacts of these shipments. Two potential routes through Washington and Oregon were analyzed in this EIS (see Figure 25). These include a route that enters Oregon from the east on Interstate 84 near Ontario, Oregon, and one that enters Oregon from the South on Interstate 5 near Ashland, Oregon. The Ontario route receives more traffic than the Ashland route. For the Lower Bound waste volumes, the Ontario route would be used for about 12,700 shipments, and the Ashland routes would be used for about 140 shipments. For the Upper Bound waste volumes, the Ontario route would be used for about 33,000 shipments, and the Ashland route would be used for about 2,800 shipments. These estimates include LLW, MLLW, and TRU shipments from offsite generators to Hanford and TRU shipments from Hanford to WIPP. Note that no fatalities are expected to occur in Washington or Oregon on either route or in total for either Upper Bound or Lower Bound waste volumes. The impacts over the entire route of transporting TRU waste from Hanford to WIPP are presented in Appendix H, Section H.5.1. The full analysis of the impacts of transporting LLW, MLLW, and TRU waste from offsite generators to Hanford are contained in the WM PEIS (DOE 1997a) and WIPP SEIS-II

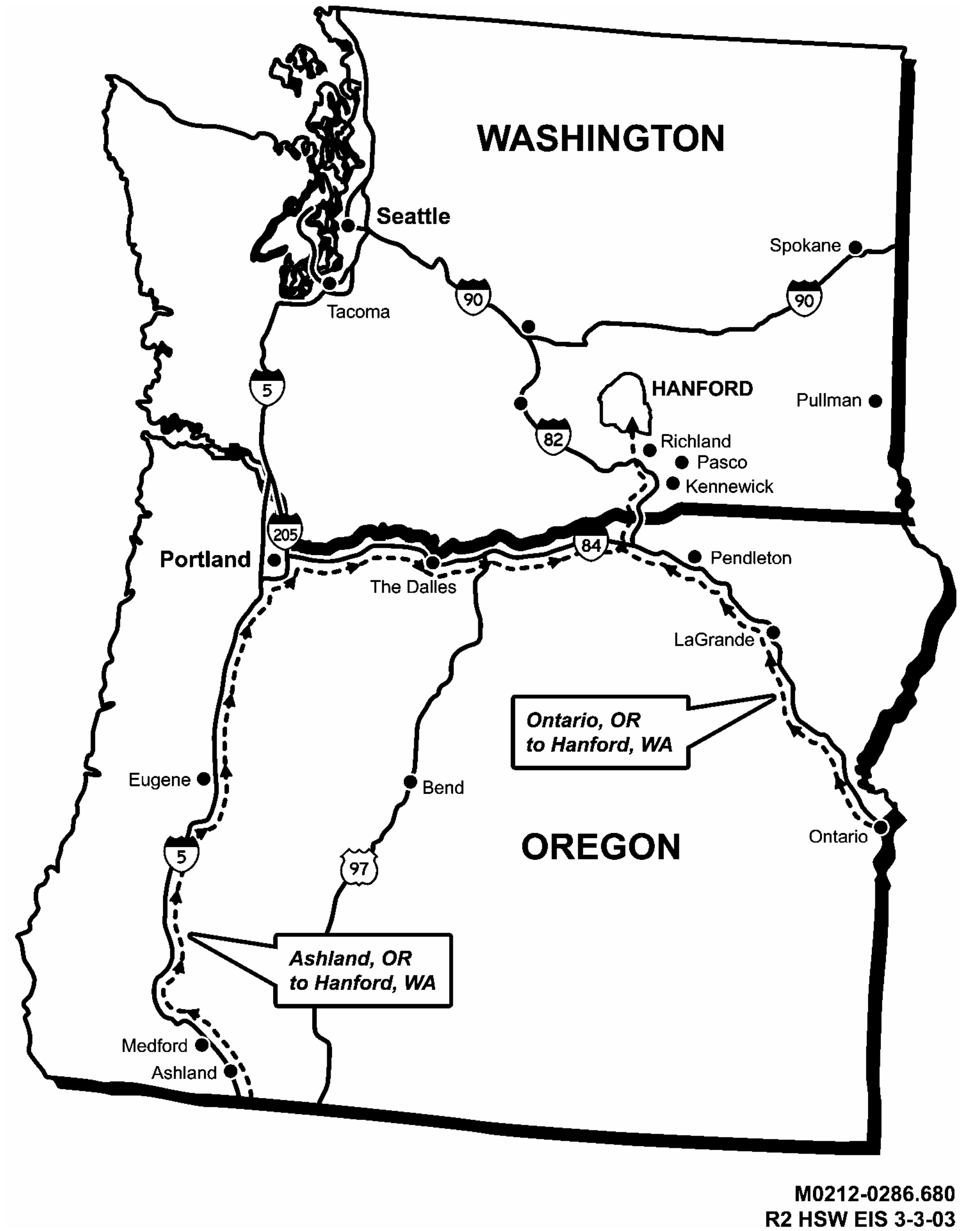

Figure 5.25. Shipping Routes in Washington and Oregon

(DOE 1997b). The routes used in these analyses and the data used to calculate the impacts include some areas with relatively high traffic hazards, such as Cabbage Hill on Interstate 84 in Oregon. Refer to Section 2.2.4 for further information on emergency preparedness for transportation accidents involving radioactive materials.

The impacts of transporting construction and capping materials to solid waste management facilities on the Hanford Site are summarized in Table 5.22. The materials that were included in the calculations included concrete, asphalt, gravel/sand, silt/loam, basalt, bentonite, and steel. Although some accidents

Table 5.20. Summary of Radiological and Non-Radiological Transportation Impacts – Hanford Only Waste Volumes, All Alternatives [(a)]

Waste Type/ Shipment	Radiological Impacts, LCFs			Non-Radiological Impacts		
	Occupational	**Non-Occupational**	**Radiological Accidents**	**Number of Accidents**	**Accident Fatalities**	**Emissions, LCFs**
Alternative Groups A, C, D, and E[(b)]						
LLW	2.9E-2	2.5E-2	1.9E-2	1.9E-1	2.0E-2	1.6E-1
MLLW	4.1E-1	1.1E-1	3.4E-3	2.0E+1	4.9E-1	1.7E-1
TRU Waste	8.6E-3	8.1E-3	4.9E-3	5.1E-2	5.6E-3	4.5E-2
ILAW	5.8E-3	1.9E-4	3.7E-11	3.5E-2	3.8E-3	3.0E-3
Total	**0** (4.5E-1)	**0** (1.5E-1)	**0** (2.7E-2)	**20** (2.0E+1)	**1** (5.2E-1)	**0** (3.8E-1)
Alternative Group B[(b)]						
LLW	2.9E-2	2.5E-2	1.9E-2	1.9E-1	2.0E-2	1.6E-1
MLLW	2.5E-2	2.3E-2	3.6E-3	5.1E-1	2.0E-2	7.5E-2
TRU Waste	8.6E-3	8.1E-3	4.9E-3	5.1E-2	5.6E-3	4.5E-2
ILAW	5.8E-3	1.9E-4	3.7E-11	3.5E-2	3.8E-3	3.0E-3
Total	**0** (6.8E-2)	**0** (5.5E-2)	**0** (2.7E-2)	**1** (7.8E-1)	**0** (4.9E-2)	**0** (2.8E-1)
No Action Alternative						
LLW	2.9E-2	2.5E-2	1.9E-2	1.8E-1	2.0E-2	1.6E-1
MLLW	3.7E-2	1.5E-2	3.8E-4	9.6E-1	2.9E-2	6.5E-2
TRU Waste	8.6E-3	8.1E-3	4.9E-3	5.1E-2	5.6E-3	4.5E-2
Total[(c)]	**0** (7.5E-2)	**0** (4.7E-2)	**0** (2.4E-2)	**1** (1.2E+0)	**0** (5.5E-2)	**0** (2.7E-1)

Note: Public includes non-involved workers.
(a) Radiological impacts (incident-free and accident) are expressed in units of LCFs. Non-Radiological accident impacts are expressed as the expected number of accidents and the resulting physical trauma fatalities. Non-Radiological emissions impacts are expressed as LCFs.
(b) The impacts in these areas are for the Hanford Only waste volume case. Impacts are included for shipments of MLLW to offsite treatment facilities and back. The impacts in Washington and Oregon from offsite shipments are presented in Table 5.16.
(c) No transportation impacts are included for transfer of ILAW cullet between the WTP and the adjacent grout vault because of their close proximity.

were predicted to occur, there were no fatalities associated with transport of construction and backfill materials. The impacts of all Alternative Groups were found to be dominated by transport of gravel/sand, silt/loam, and basalt to use as capping materials. The impacts for the No Action Alternative were found to be dominated by the transport of steel and concrete.

Table 5.21. Impacts in Washington and Oregon by State from Offsite Shipments of Solid Wastes to and from Hanford[(a)]

Waste Type/ Shipment	State	Radiological Impacts, LCFs			Non-Radiological Impacts		
		Occupational	Non-Occupational	Radiological Accident	Number of Accidents	Accident Fatalities	Emissions, LCFs
Lower Bound Waste Volume							
LLW, MLLW, and TRU Waste to Hanford[(b)]	WA	6.2E-3	2.2E-3	2.7E-4	3.9E-1	5.4E-3	7.9E-4
	OR	2.3E-2	8.7E-3	1.1E-3	1.6E+0	1.8E-2	2.9E-3
TRU Waste to WIPP	WA	6.6E-3	7.1E-3	1.4E-4	1.2E-1	2.6E-3	4.7E-3
	OR	3.1E-2	3.3E-2	6.5E-4	5.9E-1	1.2E-2	2.2E-2
Total – Offsite Shipments	WA	1.3E-2	9.3E-3	4.0E-4	5.2E-1	8.0E-3	5.5E-3
	OR	5.4E-2	4.2E-2	1.7E-3	2.2E+0	3.1E-2	2.5E-2
Grand Total	**WA + OR**	**0** (6.7E-2)	**0** (5.1E-2)	**0** (2.1E-3)	**3** (2.7E+0)	**0** (3.9E-2)	**0** (3.1E-2)
Upper Bound Waste Volume							
LLW, MLLW, and TRU Waste to Hanford	WA	3.2E-2	1.7E-2	2.6E-2	7.3E-1	1.3E-2	6.2E-3
	OR	1.4E-1	7.2E-2	1.0E-1	3.1E+0	5.0E-2	2.5E-2
TRU Waste to WIPP	WA	6.6E-3	7.1E-3	1.4E-4	1.2E-1	2.6E-3	4.7E-3
	OR	3.1E-2	3.3E-2	6.5E-4	5.9E-1	1.2E-2	2.2E-2
Total – Offsite Shipments	WA	3.9E-2	2.4E-2	2.6E-2	8.5E-1	1.5E-2	1.1E-2
	OR	1.7E-1	1.1E-1	1.0E-1	3.6E+0	6.3E-2	4.7E-2
Grand Total	**WA + OR**	**0** (2.1E-1)	**0** (1.3E-1)	**0** (1.3E-1)	**5** (4.5E+0)	**0** (7.8E-2)	**0** (5.8E-2)

Note: Public includes non-involved workers.
(a) Radiological impacts (incident-free and accident) are expressed in units of LCFs. Non-Radiological accident impacts are expressed as the expected number of accidents and the resulting physical trauma fatalities. Non-Radiological emissions impacts are expressed as LCFs.
(b) MLLW shipments include those from offsite generators to Hanford and those to ORR and back for treatment. TRU waste volumes include 1,500 m^3 in addition to the Upper Bound and Lower Bound waste volume projections to account for small-quantity sites identified in the *Transuranic Waste Performance Management Plan* (DOE 2002c).

Table 5.22. Impacts of Transporting Construction and Capping Materials

Alternative Group	Waste Volume Case	Total Distance Traveled, millions of miles	Number of Accidents	Number of Fatalities
A	Hanford Only	8.4	**2** (1.5E+0)	**0** (6.3E-2)
	Lower Bound	8.5	**2** (1.5E+0)	**0** (6.4E-2)
	Upper Bound	9.4	**2** (1.6E+0)	**0** (7.0E-2)
B	Hanford Only	11	**2** (1.9E+0)	**0** (8.3E-2)
	Lower Bound	11	**2** (2.0E+0)	**0** (8.4E-2)
	Upper Bound	15	**3** (2.6E+0)	**0** (1.1E-1)
C	Hanford Only	7.9	**1** (1.4E+0)	**0** (5.9E-2)
	Lower Bound	8.0	**1** (1.4E+0)	**0** (6.0E-2)
	Upper Bound	8.9	**2** (1.6E+0)	**0** (6.7E-2)
D	Hanford Only	7.9	**1** (1.4E+0)	**0** (5.9E-2)
	Lower Bound	8.0	**1** (1.4E+0)	**0** (6.0E-2)
	Upper Bound	8.9	**2** (1.6E+0)	**0** (6.7E-2)
E	Hanford Only	7.9	**1** (1.4E+0)	**0** (5.9E-2)
	Lower Bound	8.0	**1** (1.4E+0)	**0** (6.0E-2)
	Upper Bound	8.8	**2** (1.5E+0)	**0** (6.6E-2)
No-Action	Hanford Only	20	**4** (3.5E+0)	**0** (1.5E-1)
	Lower Bound	20	**4** (3.5E+0)	**0** (1.5E-1)
Note: The materials that were included in the impact analysis were concrete, asphalt, gravel/sand, silt/loam, basalt, bentonite, and steel. Gravel/sand, silt/loam, and basalt were assumed to be transported from Area C on the Hanford Site. Various offsite locations were considered to be the sources for the other materials.				

The results of the hazardous chemical impact analysis are presented in Table 5.23. The results indicate that downwind concentrations of only four hazardous chemicals would exceed the Temporary Emergency Exposure Limit 2 (TEEL-2) guidelines (see Appendix H, Section H.6 for a definition of TEEL-2) following a severe transportation accident. These four chemicals are elemental lead, elemental mercury, methyl ethyl ketone (MEK or 2-butanone), and beryllium. For these four chemicals, the Immediately Dangerous to Life and Health (IDLH) values are provided in the table for additional perspective. IDLH concentrations are defined as:

> **IDLH**: The maximum concentration from which, in the event of respirator failure, a person could escape within 30 minutes without a respirator and without experiencing any escape-impairment (for example, severe eye irritation) or irreversible health effects.

The downwind concentrations of all four of the IDLH chemicals are well below their respective IDLH values. Based on these observations, the conclusion was that releases of hazardous chemicals from transportation accidents involving waste materials are unlikely to result in a fatality.

Table 5.23. Hazardous Chemical Concentrations (mg/m ^{3}) 100 m (109 yd) Downwind from Severe Transportation Accidents

Hazardous Constituent	Concentration, mg/m^3					
	TEEL-2 Value[(a)]	MLLW [(b)]	TRU Waste [(b)]	Elemental Mercury	Elemental Lead	Comments
Acetone	8500	0.49	0	0	0.004	
Ammonium fluoride	12.5	0.19	0	0	0	
Ammonium nitrate	50	0.19	0	0	0	
Ammonium sulfate	500	0.38	0	0	0	
Beryllium	0.025	0.14	0.0049	0	0	IDLH = 10 mg/m^3[(c)]
Butyl alcohol	50	0.03	0.012	0	0	
Carbon tetrachloride	100	0.89	0.024	0	0	
Cyclohexane	1300	0.09	0	0	0	
Ethanol	3300	0.49	0.0049	0	0	
Hydrazine	0.8	0.21	0	0	0	
Isopropyl alcohol	400	0.71	0	0	0	
Lead	0.25	0	0	0	5.0	IDLH = 700 mg/m^3[(c)]
Mercury	0.1	0	0	0.67	0	IDLH = 10 mg/m^3[(c)]
Methanol	1000	0.95	0	0	0	
Methyl ethyl ketone (MEK)	0.2	0.58	0	0	0	IDLH = 9000 mg/m^3[(c)]
Methyl isobutyl ketone	500	0.80	0	0	0	
Nitric acid	15	1.48	0.0049	0	0	
Phosphoric acid	500	1.27	0.0073	0	0	
Potassium hydroxide	2	1.37	0	0	0	
Propane	2100	0	0.0097	0	0	
Sodium hydroxide	40	1.86	0.15	0	0	
Styrene	250	0.04	0	0	0	
Sulfuric acid	10	0.08	0.036	0	0	
Tetrahydrofuran	2000	0.07	0	0	0	
Toluene	300	2.53	0	0	0	
Uranium	1	0.009	0	0	0	
Xylene	200	1.26	0.10	0	0	

(a) Source: Craig (2001).
(b) Inventory represents bounding quantities for either CH or RH wastes.
(c) IDLH = Immediately Dangerous to Life and Health. Source: National Institute for Occupational Safety and Health (NIOSH 1990).